

SOUTH MAIN STREET BRIDGE
Spanning South Mill Race
Eaton Rapids
Easton County
Michigan

HAER No. MI-90

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

HISTORIC AMERICAN ENGINEERING RECORD
National Park Service
Northeast Region
Philadelphia Support Office
U.S. Custom House
200 Chestnut Street
Philadelphia, P.A. 19106

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HISTORIC AMERICAN ENGINEERING RECORD

SOUTH MAIN STREET BRIDGE

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Location: Spanning South Mill Race
Eaton Rapids
Eaton County
Michigan
USGS Eaton Rapids Quadrangle
UTM Coordinates: 16.692579.4708732

Date of Construction: 1907

Designers: The Riggs-Sherman Company
of Toledo, Ohio

Builder: G. Elmer McArthur
of Eaton Rapids, Michigan

Present Owner: Michigan Department of Transportation
Transportation Building
Lansing, Michigan

Present Use: Vehicular/Pedestrian Bridge

Significance: A politically prominent local citizen built the South Main Street Bridge on the basis of moderately early reinforced concrete arch design. The designers decorated the structure in City Beautiful style to complement the municipal improvement efforts of Eaton Rapids.

The Michigan State Historic Preservation Office has declared the bridge eligible for listing in the National Register of Historic Places.

Project Information: HH Engineering Ltd. of Grand Rapids, Michigan, documented the South Main Street Bridge concomitant with the structure's demolition under a Memorandum of Agreement with the Michigan Department of Transportation.

Mr. Alan L. Halbeisen observed and recorded features of the structure during demolition from 30 May to 23 June, 1995.
Dr. James L. Cooper prepared the text 29 November, 1995.

1. Local/Regional Context

The lands around what became Eaton Rapids invited water-powered industrial development in the nineteenth century. Here the Grand River, dropping through rapids, could turn many waterwheels or turbines. Still more promising, Spring Brook joined the river towards the bottom of its descent. Races cut between the upper river and the brook promised still more substantial taps on gravity's feed.

Among the nine or ten families which settled in the area in the mid-1830s, Amos Spicer began to exploit the water power when he built a sawmill about 1836 and laid Spicerville out into town lots.¹ By the end of the next year, Spring Brook sported a grist mill. A man-made dam soon partly regulated the brook's flow, and within a few years two races supplied water from the upper Grand River. The first race was dug in 1840 closest to the intersection of the river with the brook; the second--the southernmost race--channeled more-distant river water into the brook by 1843. Within a few years, the races and the brook powered sawmills, carding and woolen mills, and cabinet shops.

Mere growth of the youthful industrial center did not transform Spicerville--even when renamed as Eaton Rapids--into the county seat. Although the town fathers would not soon forget this failure to become the region's governmental center, they found some solace in the community's continuing industrial development, and boosters continued to dream expansively even as the competitive edge which water power once provided Eaton Rapids slowly faded into memory by 1900.

The municipal improvement movement which swept the nation after 1893 touched those along the Grand, too. Eaton Rapids installed water and sewer lines and began gas and electric service. Its leaders also started talking about paving major streets and sidewalks as their counterparts were doing in neighboring Grand Ledge, Charlotte, and Lansing.

¹ This historical narrative owes much to Irene J. & William R. Henry, "Historic Evaluation of the 1907 M-50/M-99 Concrete Arch Bridge, South Mill Race, South Main Street, Eaton Rapids, Michigan." Henry & Henry Preservation & Architectural Consultants of Media, Pennsylvania, prepared their evaluation for the Michigan Department of Transportation (MDOT #32473) and Bureau of History (MDOS ER #91536) in October 1992.

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2. The Decision to Build a New South Main Street Bridge

In late 1906 the Eaton Rapids City Council started talking about rescuing Main Street from spring mud by paving. The official conversations about Main Street did not stop at the South Mill Race which separated the business district from the developing middle and upper class residential neighborhoods to the south. They almost inevitably included the timber bridge which linked the two districts.

The talk turned to action in the late spring of 1907. The City Council appointed a committee "to get plans, specifications and estimated costs of constructing a cement arch bridge across race on South Main Street" in April, toured Lansing's new brick paving in May, and approved a bond issue for their own street and bridge project in June. The Council's Street Committee closed out June by engaging the "Riggs-Sherman Company of Toledo, to perform engineering work on paving for \$300.00 which amount also includes the plans and specifications for the south race bridge."²

On 15 August, the City Council approved the Riggs-Sherman Company's proposed plans and specifications for the bridge and set bidding for the 20th. The Council received two bids on "Plan B," one from Edward A. Weiland of Elyria, Ohio, for \$5,434.20, and the other from G. Elmer McArthur of Eaton Rapids at \$5,354.95. As the lowest and also local bidder, McArthur secured the contract.

² Eaton Rapids City Council Meeting Minutes (30 April, 25 June 1907), as quoted in Henry & Henry, "Historic Evaluation," 11, 12.

3. Bridge Design

The paving of Main Street precipitated the replacement of the south race bridge and set the context for some of its features. Putting the design of both the street paving and the bridge into the hands of the Riggs-Sherman Company tightened the links further. The City Council ordered plans for "a cement arch bridge," a form which municipalities engaged in civic improvement across the United States in this era characteristically favored. Since the Council included curbing and sidewalks in its paving project, the decision to build the new arch as wide as the vehicular and pedestrian thoroughfare--and therefore without interruption to the vista--seems foreordained. The Riggs-Sherman designers, in turn, probably selected a decor for the bridge in keeping with City Beautiful fashion.³

Judging from its advertising, The Riggs-Sherman Company specialized more in water works, sewerage, and paving than it did in bridge design. The company apparently prepared two sets of plans for the South Main Street bridge, neither of which has apparently survived. Plan A may have been for a steel structure, if a local reporter anticipated correctly. Alternatively, Riggs-Sherman could have offered a different concrete arch design, possibly one without decoration or one using the Melan system of reinforcing.

Since Plan B elicited the only bids available to the City for the contract it awarded, we can presume the acceptability of the second plan and surmise its design elements from the structure as built.⁴ To cross the race required a 40-ft. structure with a clear span of 30 ft. and 7 in. at the springing. To keep the bridge road-aligned called for a 65 degree skew over the waterway. And to assure an uninterrupted roadway and sidewalks necessitated a 105-ft. wide structure.

The arch ring illustrates design in transition from the Melan system of reinforcing, although it carried some family resemblances to that system. Like most Melan arches, the ring of the South Main Street Bridge was essentially segmental and deep, used heavy longitudinal reinforcing along the intrados and extrados, and sat upon a heavy and separate substructure. Unlike a vintage Melan, though, the ring's longitudinal reinforcing did not consist of I-beams or, as modified by Fritz von Emperger, of pairs of angles laced together like arched open-web girders. The design came close to the changes Edwin Thacher made in the Melan system when he substituted rods for I-beams or pairs of angles and dropped the von Emperger webbing.⁵

³ James L. Cooper, Artistry and Ingenuity in Artificial-Stone: Indiana's Concrete Bridges, 1900-1942 (Greencastle, Indiana, forthcoming), chapter I.

⁴ The following description of the structure owes much to Mr. Halbeisen's observations made during early stages of demolition.

⁵ As a principle in the Concrete-Steel Engineering Company of New York, Thacher represented Melan interests in the United States. See Supplement, Engineering News-Record 53, 56 (29 June 1905, 20 December 1906): 61, 66.

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The South Main Street Bridge's ring appears to have delineated less than a third of a semicircle, and, with a rise of 4 ft. and 9 in., it carried a rise/span ratio of only 1:6.5. At 10.5 in. at the crown and 21 in. at the abutments, the ring's depth was substantial for the span length, and so too was its reinforcing system with two independent rows of 1 5/16 in. spiral rods placed about 3 in. into the concrete from the surface of the intrados and extrados. The rods ran longitudinally without laps or variation about 12 in. apart horizontally within each row and extended approximately 8 in. into the abutment where each end was bent downward to anchor it vertically in the top of the substructure. A row of smooth 7/16 in. transverse tie bars alternated about every 21 in. just above the top and bottom longitudinal rows of the heavier spiral rods. Laced between the rows of transverse rods, wire probably held the rods in place while the concrete was being poured and set.

The heavy abutments, each at least 3 ft. and 6 in. deep and 6 ft. wide, were constructed in two phases. McArthur laid the approximately 2-ft. base of each abutment before erecting the falsework for the ring, placing its reinforcing, and then pouring the concrete for the ring and the upper portion of the abutments in a continuous round. The abutments contained no reinforcing beyond that extended from the ring.

Riggs-Sherman designed relatively heavy and independent spandrel walls. At 1 ft. and 4 in. thick, they were substantial given their very limited height. As was characteristic of much Melan era design, Riggs-Sherman also left the spandrels altogether unreinforced, thus neither using the walls as an aid to the span's carrying nor resisting separation from the ring over time. Sand provided the fill between the ring and the 6 in. concrete slab roadway base which in turn carried the street's pavement of Metropolitan Brick (from Canton, Ohio) over the span.⁶ Later, the road was widened to the East with a concrete slab and the whole roadway overlaid with bituminous.

The South Main Street Bridge bore many external hallmarks of a City Beautiful structure. It carried wide concrete sidewalks on each side of the roadway. Its spandrel walls had indented chamfered panels which followed the lines of the ring below and of the parapet base above. Each 34-ft. and 3-in. parapet rail consisted of precast concrete elements (lower and upper copings; posts, caps, and balls; balusters). The base copings were 10 in. high and 18 in. wide. At 6 in. high, the upper copings were slightly chamfered and extended from post to post. Four 14-in. square posts with chamfered indented panels bordered the three equal-length sections of each rail. The posts originally carried square flat caps, each of which also held--through reinforcing rods as dowels--an ornamental ball or globe. Five 31-in. high urn-shaped balusters sat doweled in between the copings from post to post. Each urn was bordered with a 12-in. square base and cap.

⁶ The depth of all elements of the fill over the crown totaled 12-15 in.

4. Bridge Construction

G[eorge]. Elmer Anderson, who won the contract to build the South Main Street Bridge, lived with high public visibility in Eaton Rapids and vicinity. Acts of personal courage and outspoken stands on political and social issues established his considerable public persona. Rescuing a young man from drowning in the Grand River in 1916 won Anderson the Carnegie Medal for heroism. He marked his early career as a Republican state legislator by vigorously promoting Prohibition before World War I. During the Great Depression he sought to relieve distress by eliminating city taxes and helping area residents fend off labor organizers. As Eaton Rapids mayor from 1939 to 1941, the fiscal conservative also sold the public library building and fired the librarians.

Although it entered only marginally into Anderson's lifetime activities and overall reputation, bridge-building occupied a place for a few early years. Having volunteered for service in the Spanish-American War, the young Anderson graduated in absentia from Eaton Rapids High School. On his return from war, he worked briefly as a cooper--his father's occupation--a miner, and a clothing salesman. He also organized with his father, Ira, the Eaton Rapids Artificial Stone Company, a concrete and concrete block manufacturing firm. As the company's manager, G. Elmer built a small reinforced concrete bridge near Eaton Rapids in 1901. Collectively, the savings from these many ventures permitted Anderson to enroll in the University of Michigan's School of Law in 1902.

With an LLB in hand by 1905, Anderson returned to Eaton Rapids only to find a law practice difficult to establish quickly and the need to piece a livelihood together continuing at least temporarily. The concrete business was still there to fall back on, especially while the Eaton City leaders funded municipal improvement projects. Anderson won a share of the city's contracts to lay concrete curbs and sidewalks as well as to build the South Main Street Bridge.

As with life generally, the young G. Elmer Anderson attacked bridge-building with seemingly boundless energy. He reportedly invented a grout mixing machine in January 1907 and a gas-powered concrete mixer in July, the latter of which he used to mix concrete for the South Main Street Bridge at a rate equal to the output of seven men working by hand. When a rainy late summer filled the south race and inundated the area where the abutments needed to be built, Anderson rented a pump to remove water from the construction area and then added a night crew to work with the pump and the mixer.

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Workmen began to cut the forms for the arch ring in mid-September. But, since the reinforcing steel did not arrive from Buffalo until early October, the formwork was not installed until mid-October. The delay in the delivery of the reinforcing generated labor problems for Anderson. The paving of Main Street and the construction of a large commercial building in the area had already soaked up most of the local labor not employed in the agricultural harvest season. With the arch ring completed and apparently adequately set by early November, Anderson's crew began a week of filling the structure.

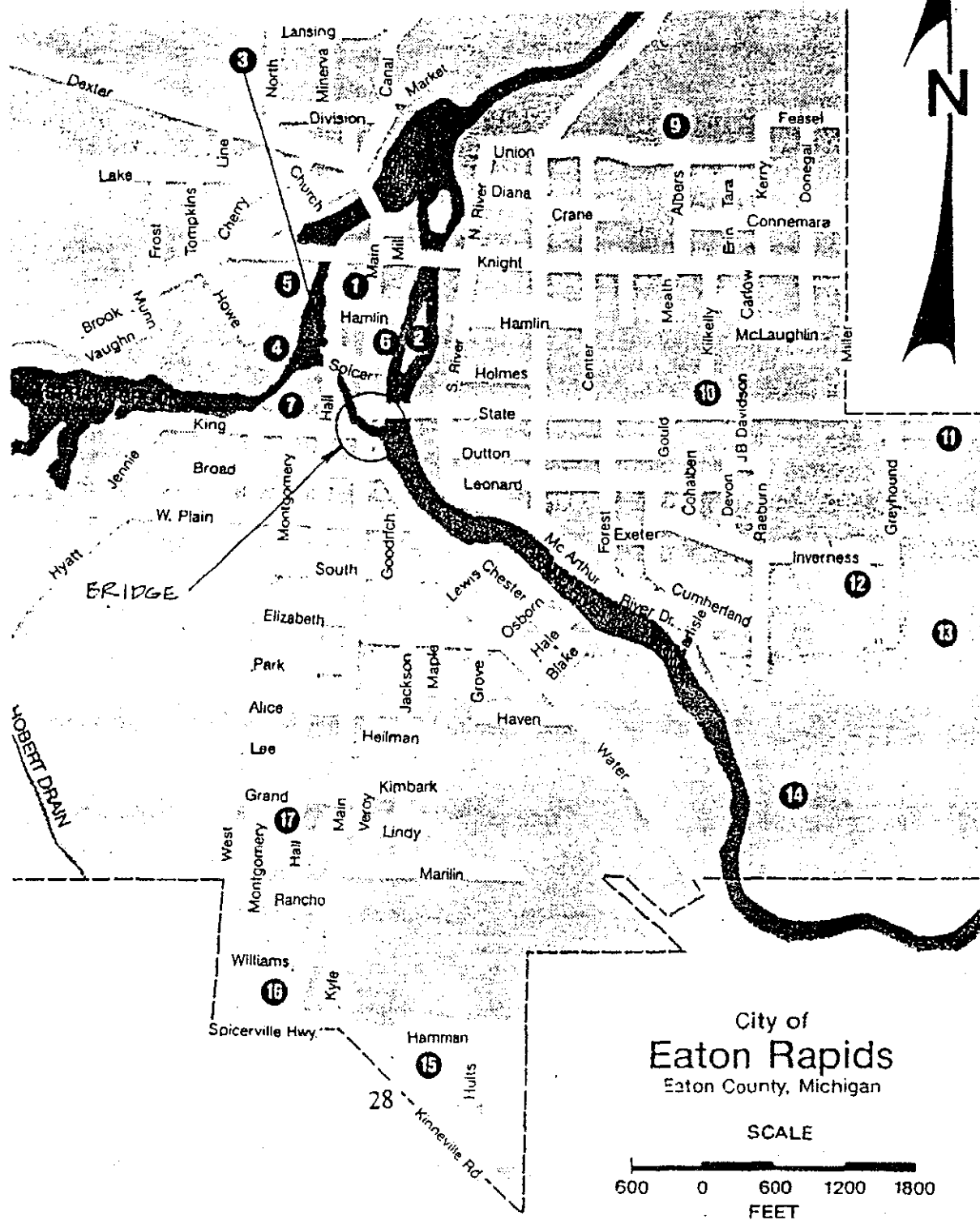
Eaton Rapids engaged a Dexter Blake to extend Main Street's new brick pavement across the bridge in mid-November. Anderson removed the formwork from under and around the bridge before opening it for traffic on 20 December. All but the sidewalks were complete. Pedestrians would have to use cinder paths until spring and the construction of paved walks.

Along with the completion of the South Main Street Bridge, G. Elmer Anderson celebrated Christmas with marriage in a private ceremony in a house he had recently finished building, too. Anderson would soon turn all his energies to the law and then to politics. There is no evidence that he engaged in any form of bridge construction after he was elected as Eaton Rapids' City Attorney in 1909.⁷ He did continue with residential construction for several years.⁸

⁷ Henry & Henry report that an Eaton Rapids historian claimed McArthur built several bridges in nearby communities without citing any particular ones. McArthur is only known to have asserted construction-paternity for two bridges, a "culvert" near Eaton Rapids (1901) and the South Main Street Bridge (1907). "Historic Evaluation," 18.

⁸ Mrs. Catherine Henry Halbeisen reports that McArthur built many residences in the City, including one of her childhood homes. Mr. McArthur had two other significant impacts on Mrs. Halbeisen's life; the man he saved from drowning became her employer for many years, and during his service on the Selective Service board during World War II he granted a farm deferment to her soon to be husband, Mr. Donald Halbeisen. Mrs. Halbeisen also reports that Mr. McArthur was known for another act of bravery, pulling a man out of a burning building.

SITE LOCATION MAP



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SITE PLAN

